

CLAIMS

What is claimed is:

1. An LED array formed of a plurality of LEDs, each LED or group of identically colored LEDs comprising a dominant wavelength within the visible spectrum (400 to 750 nm) having overall luminance sufficient to illuminate an object from a distance of at least 24 inches.
2. The LED array according to claim 1, wherein each LED or group of identically colored LEDs within the LED array is configured for independent control.
3. The LED array according to claim 1, wherein each LED or group of identically colored LEDs produces colored light with a spectral half-width of less than about 60 nm.
4. The LED array according to claim 1, wherein each LED or group of identically colored LEDs produces colored light with a spectral half-width of less than about 40 nm.
5. The LED array according to claim 1, wherein each LED or group of identically colored LEDs produces colored light with a spectral half-width of less than about 30 nm.
6. The LED array according to claim 1, wherein the plurality of LEDs comprises at least the following specified colors and within 25 nm of an associated dominant wavelength: violet 425 nm, blue 465 nm, cyan 500 nm, green 530 nm, lime 555 nm, amber 580 nm, orange 610 nm and red 650 nm.
7. The LED array according to claim 6, wherein the plurality of LEDs further comprise associated dominant wavelengths within 15 nm of the specified colors and dominant wavelengths.

8. The LED array according to claim 6, wherein the plurality of LEDs further comprise associated dominant wavelengths within 5 nm of the specified colors and dominant wavelengths.

9. The LED array according to claim 1, wherein the plurality of LEDs comprises at least the following specified colors and within 25 nm of an associated dominant wavelength: violet 405 nm, indigo 445 nm, blue 480 nm, cyan 510 nm, green 535 nm, lime 555 nm, yellow-amber 575 nm, orange 600 nm, orange-red 630 nm and deep red 665 nm.

10. The LED array according to claim 9, wherein the plurality of LEDs further comprise associated dominant wavelengths within 15 nm of the specified colors and dominant wavelengths.

11. The LED array according to claim 9, wherein the plurality of LEDs further comprise associated dominant wavelengths within 5 nm of the specified colors and dominant wavelengths.

12. The LED array according to claim 1, wherein the plurality of LEDs comprises at least the following specified colors and within 25 nm of an associated dominant wavelength: violet 410 nm, indigo 445 nm, blue 475 nm, cyan 500 nm, aqua 520 nm, green 540 nm, lime 555 nm, yellow 570 nm, amber 590 nm, orange 610 nm, red-orange 635 nm and deep red 665 nm.

13. The LED array according to claim 12, wherein the plurality of LEDs further comprise associated dominant wavelengths within 15 nm of the specified colors and dominant wavelengths.

14. The LED array according to claim 12, wherein the plurality of LEDs further comprise associated dominant wavelengths within 5 nm of the specified colors and dominant wavelengths.

15. The LED array according to claim 1, wherein each dominant wavelength is separated from its nearest neighbor on either side by not more than about 40 nm.

16. The LED array according to claim 1, wherein each dominant wavelength is separated from its nearest neighbor on either side by not more than about 30 nm.

17. The LED array according to claim 1, wherein each dominant wavelength is separated from its nearest neighbor on either side by not more than about 20 nm.

18. The LED array according to claim 1, wherein separation between the dominant wavelengths gradually increases away from either side of approximately 555 nm.

19. The LED array according to claim 1, further comprising LEDs with a dominant wavelength in the near-ultra-violet region defined from about 300 nm to about 400 nm.

20. The LED array according to claim 1, wherein the plurality of LEDs number less than or equal to 100 LEDs.

21. The LED array according to claim 1, wherein the plurality of LEDs number less than or equal to 64 LEDs.

22. The LED array according to claim 1, wherein the plurality of LEDs number less than or equal to 36 LEDs.

23. The LED array according to claim 1, wherein the plurality of LEDs number less than or equal to 16 LEDs.

24. The LED array according to claim 1, wherein each of the plurality of LEDs comprises at least 0.25 Watts of power at full brightness.

25. The LED array according to claim 1, wherein each of the plurality of LEDs comprises at least 0.5 Watts of power at full brightness.

26. The LED array according to claim 1, wherein each of the plurality of LEDs comprises at least 1.0 Watts of power at full brightness.

27. The LED array according to claim 1, wherein an area enclosed by plotting an output of each LED on a CIE Chromaticity diagram as a point and connecting the points covers at least 75% of the total area defined within the curve of spectrally pure colors and an alychne of purple colors.

28. The LED array according to claim 1, wherein an area enclosed by plotting an output of each LED on a CIE Chromaticity diagram as a point and connecting the points covers at least 85% of the total area defined within the curve of spectrally pure colors and an alychne of purple colors.

29. The LED array according to claim 1, wherein an area enclosed by plotting an output of each LED on a CIE Chromaticity diagram as a point and connecting the points covers at least 95% of the total area defined within the curve of spectrally pure colors and an alychne of purple colors.

30. The LED array according to claim 1, wherein relative luminance values for all LEDs within the LED array operating at full brightness levels results in a composite white-type light that may be plotted on a CIE Chromaticity diagram within McAdam ellipses that are on or adjacent to a Planckian Locus within a predefined correlated color temperature (CCT) range.

31. The LED array according to claim 30, wherein the predefined CCT range comprises between about 1500°K and about 25,000°K.

32. The LED array according to claim 30, wherein the predefined CCT range comprises between about 3000°K and about 10,000°K.

33. The LED array according to claim 30, wherein the predefined CCT range comprises between about 4500°K and about 7500°K.

34. The LED array according to claim 30, wherein the predefined CCT range comprises between about 5500°K and about 6500°K.

35. The LED array according to claim 1, wherein relative luminance of each LED or group of LEDs in the LED array comprises a spectral power distribution within 30% normalized mean deviation of a spectral power distribution of midday sunlight having correlated color temperature (CCT) of about 6500°K.

36. The LED array comprising Luxeon™ LEDs in a base mix of one red LED, one red-orange LED, six amber LEDs, three green LEDs, two cyan LEDs, two blue LEDs and one royal blue LED.

37. The LED array according to claim 36, wherein the LED array comprises a 2x8 base mix strip array configured as:

B	G	C	I	G	B	C	G
A	R	A	A	A	O	A	A

where R = red, O = red-orange, A = amber, G = green, C = cyan, B = blue and I = royal blue.

38. The LED array according to claim 37 wherein the dominant wavelengths of the LEDs are within 15 nm of the following: I = royal blue = 455nm, B = blue = 470nm, C = cyan = 505nm, G = green = 530nm, A = amber = 590nm, O = red-orange = 617nm and R = red = 625nm.

39. An array of base mix strip arrays according to claim 36.

40. A linear array of base mix strip arrays according to claim 36, wherein the base mix strip arrays are stacked vertically or horizontally.

41. The LED array according to claim 36, wherein the LED array comprises a 2x8 reverse base mix strip array configured as:

A	A	O	A	A	A	R	A
G	C	B	G	I	C	G	B

where R = red, O = red-orange, A = amber, G = green, C = cyan, B = blue and I = royal blue.

42. An array of reverse base mix strip arrays according to claim 41.

43. A linear array of reverse base mix strip arrays, according to claim 41, wherein the reverse base mix strip arrays are stacked vertically or horizontally.

44. The LED array according to claim 36, wherein the LED array comprises a 4X4 base mix array configured as:

B	G	A	C
A	R	G	A
A	I	O	A
C	A	G	B

where R = red, O = red-orange, A = amber, G = green, C = cyan, B = blue and I = royal blue.

45. An LED lighting system, comprising:
a power supply;
an LED array formed of a plurality of LEDs emitting at least the following discrete wavelengths of visible light: red, red-orange, amber, green, cyan, blue and royal blue; and
a controller in communication with the power supply and the LED array for selectively varying the intensity of light emitted by the LEDs.

46. A method of testing human visual perception comprising:
turning white reference lights on;
warming up a human test subject's color perception;
calibrating the human test subject's color perception;
establishing detailed comparisons;
repeating above using different color order;
turning white reference lights off; and
identifying perceived differences in white light between conventional sources and various LED mixes.

47. The method according to claim 46, wherein establishing detailed comparisons comprises:
quantifying perceived differences between color mixes;
comparing various LED mixes with filtered, full-spectrum conventional light sources; and
establishing an optimal mix of LED colors within an array.